THE LOW BACK VOWEL IN MID-COAST MAINE

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A

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ABSTRACT

In mid-coast Maine, the words *cod* and *caught* sound like they contain the same vowel phoneme, employing the sound [ɑ], a low back vowel. The word *father* contains a separate contrasting phoneme, spoken as [a], a low central vowel. This paper attempts to show that this perceived similarity in [ɑ] and difference from [a] is in fact real. Unlike in the area of the Northern Cities Chain Shift, where the sound of the vowels in *cod, caught* and *father* all approach [a], the vowel in *cod* and *caught* in mid-coast Maine remains low and back, occasionally rounded, more often not, while that in *father* is low and central. Twenty-six current speakers of varying ages, most residents since early childhood, were interviewed to compare these sounds. Each speaker was recorded reading a prepared story and a set of words included in a frame sentence. Formant frequencies for this recorded data were then analyzed. Statistical tests, including t-tests and ANOVAs, were run to compare the vowels and to test the validity of the hypothesis. Normalizing the data for one single vowel sound proved to be unworkable, so men and women were treated separately, as were Narrative and Frame data. The low back vowel was found to be stable in mid-coast Maine, including the same sound in *cod* and *caught*, and it was found to contrast with the low central vowel in *father*. Available historical evidence points to these vowels having been stable in this region for over a hundred years. This contrasts with changes in the vowel sound in the same words in the rest of the United States.

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CHAPTER 1 INTRODUCTION

1.1 Objectives

In mid-coast Maine (Figure 1), cod is caught by fishermen who pronounce the vowels in *cod* and *caught* so that they sound the same, a low back vowel, sometimes rounded, more often not, and distinct from the vowel sound in *father*. The objectives of this study are twofold:

- to provide a body of dialect data for a region of Eastern New England that has not been studied since Kurath's monumental *Linguistic Atlas of New England* (LANE, 1939-43); and
- to examine the presence or absence of the so-called *father-bother* merger (that of IPA /a/ and IPA /ɑ/) and the so-called *caught-cot* merger (that of IPA /ɔ/ and IPA /ɑ/) (Nagy, Roberts, and Boberg, 2000; Nagy and Roberts, 2004) in this low back vowel.

The study examined a small geographic area along the Maine coast between Brunswick and Cushing (Figures 1 and 2), an area where the author has family ties and a lifetime of visiting. The area was limited in size in order to limit variables which might be dependent on geography. Later, a speaker from Mt. Vernon, a small town near Farmington, slightly further north, was added to the study, due to a lack of younger speakers in the original area.

Mid-coast Maine is a sociological contrast in lifestyles. Land along the coastline itself is mainly owned by out-of-state people in high income brackets who

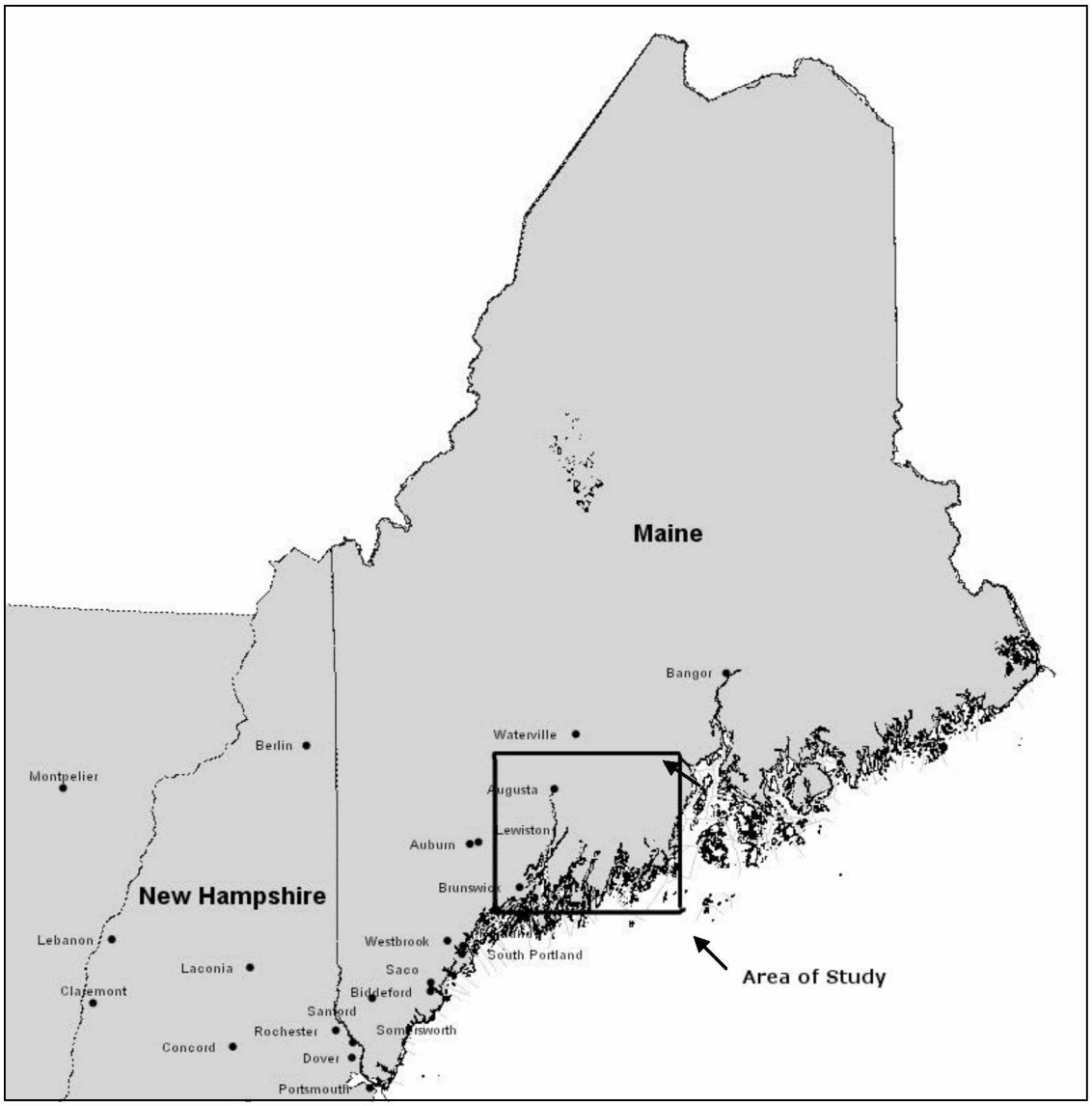

Figure 1. The State of Maine, with the Mid-Coast area of study outlined.

come for the summer. A number of well-to-do retirees live in the area; some grew up here, some moved in at retirement. The majority of the local population are fisherman, farmers, and independent businessmen who run shops, plumbing businesses, and the like. The people included in this study are, among others, farmers, nurses, teachers,

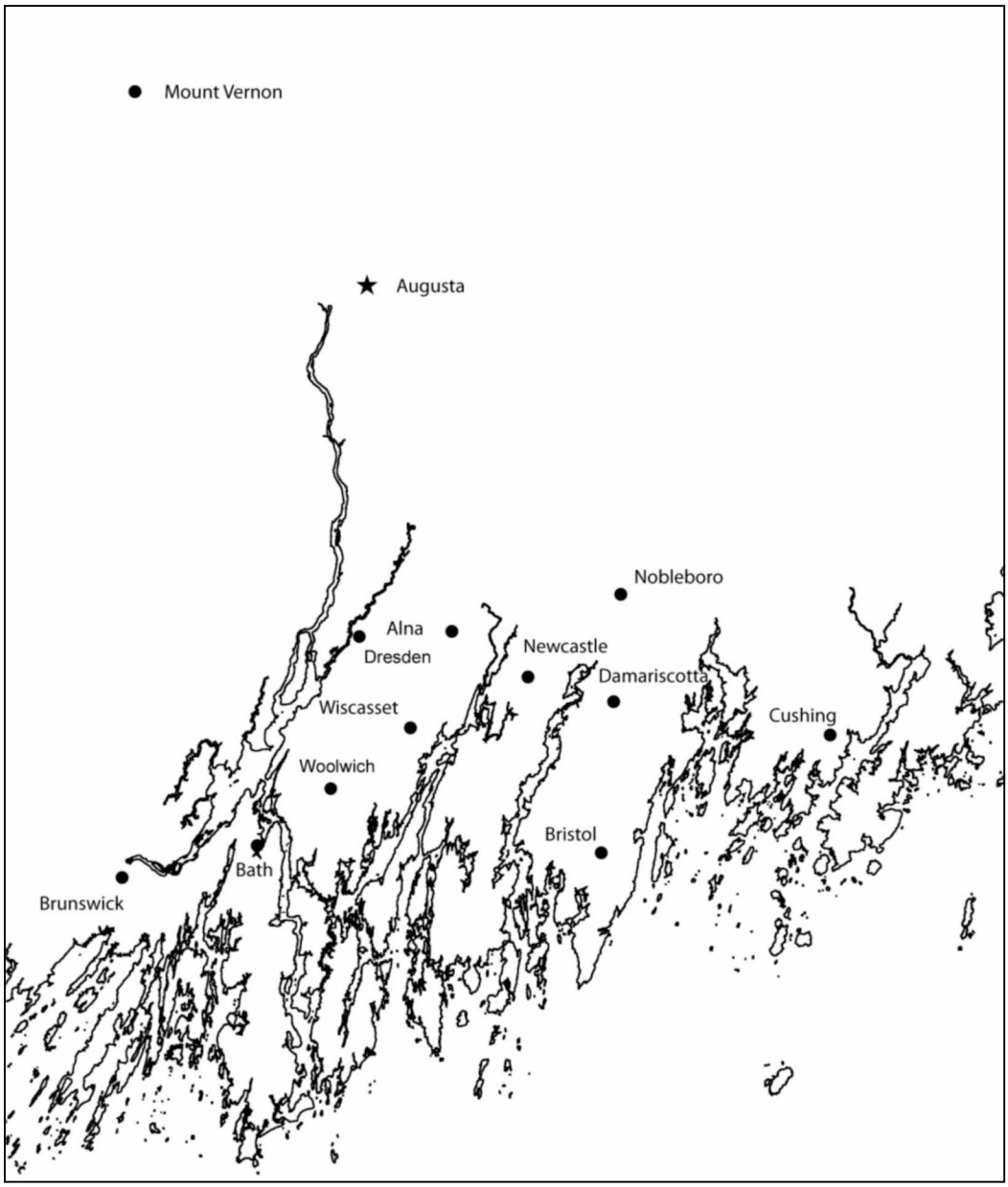

Figure 2. The area of study outlined in Figure 1. The home towns of the speakers in the study are shown with dots. Augusta, the capital of Maine, is shown with a star.

and cafeteria workers.

In an attempt to examine the low back vowel in the context of the local dialect, this study collected field data from 26 speakers in the area and one from somewhat

inland. One speaker was eliminated because he grew up in Pennsylvania and moved to Maine as an adult. The 26 remaining speakers include 12 men and 14 women. One of the men and one of the women moved to the area as young children; the others have lived in or near this part of Maine for their entire lives. A great majority of their parents were also long time residents. Several left the area to attend college or to serve in the Army, but all returned after only a few years away, and the effect of these absences on their speech appears minimal. Interestingly, several stated that they tried not to talk like Mainers, so as not to "sound like hicks." The speakers range in age from 26 to 85. The youngest speaker (26) was recruited from Mt. Vernon, Maine, a town somewhat inland, because as was stated by those in their 30's, "All the younger people have left" the mid-coast region. Other, older speakers from Mt. Vernon will be discussed in the historical section to follow.

1.2 Previous Work

1.2.1 Settlement History

English immigrants settled in the Boston coastal area in the early 1600's. Newer settlers moved west to the Lower Connecticut River Valley in what is now central Connecticut, looking for better farm land (Kurath, 1939, Carver, 1987, Nagy and Roberts, 2004). In general these two original communities ("hearths"), settled between 1620 and 1640, were populated by immigrants directly from England. During the second wave of settlement, up to 1675, people from the Boston hearth spread along the coast to New Hampshire and Maine, and people from the Connecticut hearth spread up the river systems inland to western Massachusetts and Vermont (Carver, 1987).

Rhode Island is a special case; it was settled by religious dissidents from the Massachusetts Bay Colony (Carver, 1987), generally following Roger Williams. Another special case occurs along the Maine border with Canada, where the influence of Canadian settlement is quite strong. Later settlement in northern Maine, New Hampshire, and Vermont by French-Canadian speakers has had an influence on the phonology of some areas, particularly penetrating south to a large colony in Manchester, New Hampshire (Nagy and Roberts, 2004).

Patterns of settlement divided along the boundary of the Green Mountains in Vermont, with the east and west sides being isolated from each other for many years. Western Vermont was settled in the 18th century by people from the lower Connecticut Valley and from New York, as well as some from over the mountains in the remainder of Vermont, New Hampshire, and Maine. Kurath (1939) draws a very strong dialect boundary along the line of the Green Mountains and carries it throughout his work, as shown in Figure 3.

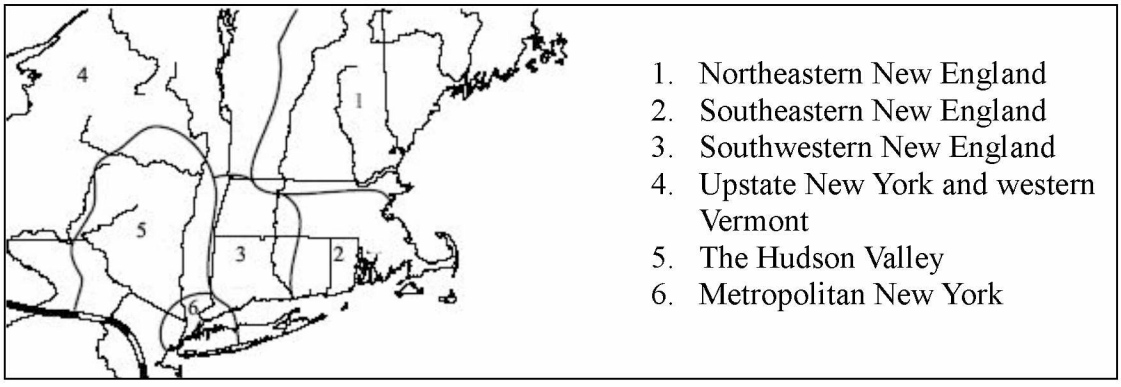

Figure 3. Dialect regions of New England. Modified from Boberg (2001), which was modified from Kurath (1939).

Other authors have continued to follow this division, often based on lexicon rather than pronunciation. According to Boberg (2001), Kurath and Carver agree that western New England is the staging ground for the initial English-speaking settlement further to the west in the Inland North.

1.2.2 Relevant Vowel Studies

Every researcher hears something different in the vowels they are studying and may use different symbols to express this. Symbols may also be assigned arbitrarily, and this can cause confusion, since we see different symbols for similar sounds. A summary of symbols used by different authors is shown in Table 1. The current work follows the IPA standard, with a modification as shown in Table 1 and Figure 4.

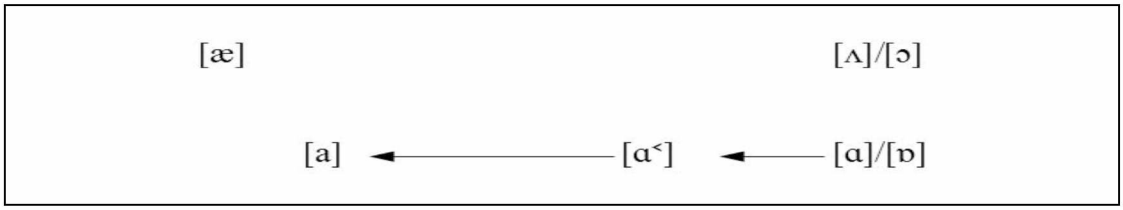

Figure 4. Modified portion of the IPA chart showing symbols for vowel sounds in this study.

Hans Kurath began what was intended to be a nationwide comprehensive study of dialects with his *Linguistic Atlas of New England* (LANE, 1939-43). This work was supplemented by the Handbook of the Linguistic Geography of New England (Kurath, 1939), which describes the Atlas in detail, giving the background for the Atlas's maps. The Atlas itself is a wealth of information on the dialect of the time, including both vocabulary and pronunciation. Speakers were interviewed in closely-spaced towns all

Table 1. Symbols used in the literature.

	Front	Low-central, unrounded	Low back central, unrounded	Low back, unrounded	Low back, rounded	Mid back, rounded
IPA		/a/		/ɑ/	/ɒ/	/ɔ/
Kurath, 1939		/ɑ/		/ɒ/, /ɒ^/, /ɒ</		/ɔ/, /ɔ^/
Labov, 1972		/o/				/oh/
Labov, 1994		/a/		/ʌ/		/ɔ:/
Labov, 1997				/o/		/oh/
Nagy and Roberts, 2004		/a/		/ɑ/	/ɒ/	/ɔ:/
Herman and Herman, 1947	/a/					
Wolfram and Schilling-Estes, 2006	/æ/	/ɑ/				/ɔ/
This work		/a/	/ɑ</	/ɑ/	/ɒ/	/ɔ/

over New England by 9 different field workers. Though not always successful, an attempt was made to interview three different types of informants in each selected town:

- An elderly descendent of an old local family, generally a farmer or his wife, with little formal education,
- A middle-aged person, native to the community, with more education (high school level) and more outside contacts than the first informant, and
- A "cultured" person with a college education or the equivalent. (Kurath, 1939).

In the region of interest to this work, two speakers were interviewed in the Waldoboro/Nobleboro area, the first a farmer and miller, age 99, and the second a "cultured informant" (Kurath's term), described as a "very intelligent" woman of 50

years. Two speakers were also interviewed in Farmington, the first a farmer, age 67, and the second a "cultured" college student of 22, attending Colby College in nearby Waterville.

Little work was subsequently done on New England dialects until Carver (1987) examined the vocabulary of the region. Unfortunately, he did not address phonetics, so the speech of Maine known to the rest of the nation and the world remained that of "Bert and I" (Dodge and Bryan, 1958)—a recording of humorous Maine stories in the manner of the speech of "Down East", the segment of Maine further north and east than the present study covers. Many of the old fishermen of that region speak as those in the recording do, but it is not majority speech.

The Northern Cities Chain Shift (NCCS) is one of two patterns of shifting vowels in the US today (Wolfram and Schilling-Estes, 2006), the other being the Southern Vowel Shift. Labov, Yaeger, and Steiner (1972) switch between phonemic (/-/) and phonetic ([-]) transcriptions in his explanation of three different resolutions for the unstable low back vowel relationship:

> The Northern chain shift is one of three resolutions to the most unstable relationship in English phonology: short vs. long open o̲. It appears that this opposition is difficult to maintain in its original form: [ɔ~ɔ:]. … In America, except for Eastern New England and some coastal Southern areas, the lax or short member unrounded to [ɑ] in the nineteenth century. In Eastern New England, the /o/ and /oh/ fell together, as a low back rounded vowel; this also happened in Western

> Pennsylvania and in most of the West… In the northern cities we find a third resolution. Instead of /oh/ rising, /o/ moves to the front.

It is in the context of the possibility of shifting that this study will examine the low back vowel. Figure 5 shows the movement of vowels in the Northern Cities Chain Shift.

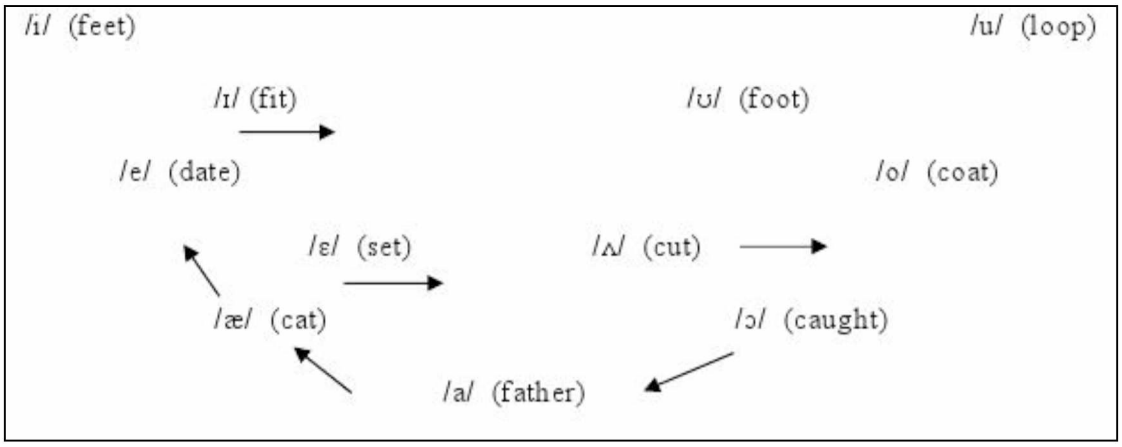

Figure 5. The Northern Cities Chain Shift (adapted from Wolfram and Schilling-Estes, 2006).

Although Kurath's LANE work from the first half of the twentieth century is the definitive work on New England speech patterns, a few later researchers have taken up the task of examining more recent changes. Boberg (2001) concludes that the shifts he sees in western Vermont, on the western side of Kurath's original line dividing New England down the Green Mountains of Vermont, are the origins of the Northern Cities Shift, corroborating Labov's (1991) findings. Studies of the NCCS show the mid back vowel /ɔ/ moving forward and down to displace the central low /a/, which then moves upward and front, pushing /æ/ further up, as in Figure 6 (Wolfram and Schilling-Estes, 2006, notation changed to match this study). The low back vowels /ɑ/ and /ɒ/ shown in Figure 4 are completely left out of discussions of the NCCS in the literature.

> The field of dispersion of /æ/ has moved well up into the high-front quadrant, /ɑ/ straddles the low-central region, /ɔ:/ is in lower-mid back position, /ɛ/ is well-centralized, and /ʌ/ has been inserted, as it were, between / ɑ / and / ɔ:/ in low-back position. (Labov, 1994)

Labov, Ash, and Boberg (2005), in their comprehensive study of sound change in the United States, interviewed a very limited number of speakers from eastern New England, which makes their interpretation of vowel sound change in this area suspect.

Nagy, Roberts, and Boberg (2000) conclude that the characteristic dialect of New England, particularly Eastern New England, is receding due to an influx of General American used by newcomers and mass media. The high tech environment of modern New England attracts others who bring in different speech patterns, and more r's are heard. They state, however, that the rest of the country is becoming more like New England in the merging of *cot* and *caught*, a statement with which this author disagrees. Though much of the rest of the country is merging these two phonemes, it is as /a/, not as the /ɑ/ or sometimes more rounded /ɒ/ phonemes that eastern New Englanders use.

1.2.3 Mergers

The Northern Cities Chain Shift is exemplified by the mergers of the vowels of *cot* and *caught* and of *father* and *bother*, both to a more low central position occupied by /a/, shown in Figure 5.

- *Father/bother* merger

To many General American speakers, *father* and *bother* rhyme. This is not so in

much of New England, where these two words have different phonemes. In eastern New England, the vowel in *father* is /a/, whereas in *bother*, it is /ɑ/ or occasionally /ɒ/. Nagy's (2001) data show that only 20% of her Massachusetts respondents merge these low back vowels, but that 40% of her New Hampshire respondents do. The tendency to merge these vowels is most pronounced in the southeast corner of New Hampshire, closest to Boston, while in the northern part of the state, the merger is very uncommon. An age comparison of the merger shows it happening among speakers younger than 50. She misses the point that about 50 years ago, there was a great in-migration to this part of New Hampshire from outside of New England (this from personal experience of this author, as well as personal communication from a former Nagy graduate student from Nashua, New Hampshire), bringing a new dialect to the region. Nagy and Roberts (2004) report that there is no merger in Calais, Maine, a town along the Canadian border. Boberg (2001) does not report on this phoneme, though Herman and Herman (1947) state that the broad [a] is used in Western New England. There is apparently no previous data available for the Maine coast.

- *Cot/caught* merger

Nagy and Roberts (2004), quoting LANE (1939-43) and Boberg (2001), state that as early as the 1930's, there was a major split at the Eastern/Western New England dividing line concerning the phoneme in *lot* and *thought*. (This is another example of the same vowels used in *cot* and *caught*.) At that time, Western New England showed two distinct phonemes, [ɑ] and [ɔ:], while Eastern New England used [ɒ] for both.

They report that in more recent times, the two vowels are distinct in Calais, Maine, a result of its proximity to the speech of New Brunswick. Labov, Ash, and Boberg (1997) report a complete merger of what they call /o/ (/ɑ/) and /oh/ (/ɔ/), but they have only three samples for Eastern New England at this time. Nagy and Roberts (2004) state that Labov, Ash, and Boberg (1997) report that in Vermont, seven of eight respondents have now completely merged the two vowels, but they do not say to which phoneme they have merged. Nagy and Roberts (2004) recognize that Eastern New England speakers use [ɒ] (and more often [ɑ]) for both *lot* and *thought* (or *cot* and *caught)*, as they always have, while Western New England speakers merge the two distinct phonemes they once had, but they do not state to which phoneme the vowel has merged. The point that the phoneme in question in Eastern New England (/ɑ/) is different from that to which other regions have merged (/a/) appears to be lost on Labov, Ash, and Boberg (1997), who merely report a merger that matches General American speech.

CHAPTER 2 METHODOLOGY

2.1 Research Design

The research was designed to include a large number of words with the low back vowel IPA /ɑ/ or more rounded /ɒ/ to test whether this is indeed the vowel used in this region of the Maine coast. In particular, an attempt was made to include as many word pairs as possible that might include /ɒ/, /ɔ/, or /ɑ/, for example *cot* and *caught* or *Don* and *dawn*. The words used, paired when possible, are shown in Table 2. In this table, the words have been separated according to General American phonemes (unaffected by the Northern Cities Chain Shift), according to Dr. G. Burns Cooper (personal communication).

A narrative including many of the words was written to attempt to fit the knowledge and lifestyle of the likely participants in the study. 64 tokens of the low back vowel were included in the narrative, which is included in Appendix A. Others of the words were placed in a constant context frame of the form "Sarah said _____ again". This sentence was chosen because every word makes sense when placed into it. *Sarah* was chosen as the name in the sentence because its vowels can vary in this region, though they are not the focus of the study. The sentence finishes with *again* because the non-rhoticity that is common in Eastern New England speech does not generally occur before vowels, so use of this word eliminates one variable from the sound of the vowels in question. These 49 tokens of the low back vowel are included in Appendix B.

The research attempted to include the 10-year age groupings:

Table 2. /ɑ/ words and /ɔ/ words, minimal pairs when possible. (G. B. Cooper, personal communication).

/ɑ/	/ɔ/
	all
	although
	awl
	ball
	bawl
body	bawdy
bother	
bottle	
bottoms	bought
cot	caught
cod	cawed
coddle	
clods	clawed
	Claude
	coffee
Don	
dotty	daughter
	dawdle
Dot	dog
fond	fawned
fodder	fought
	hallway
	haul
	hauled
hot	haughty
	laud
	law
	lawn
	log
	logs
	mall
	maul
model	Maude
modern	
not	
knotty	naughty
	off
	often
on	
onto	
upon	
pod	pawed
pond	pawned
pot	
sod	sawed
	sought
stock	stalking
tock	talk
	tall
Tom	
yon	yawned

- 20-29
- 30-39
- 40-49
- 50-59
- 60-69
- 70-79
- 80+

The plan was to include speakers who were raised in the area, preferably born there, and preferably had parents born and raised there. The hope was to find speakers who had not left the area for any length of time, except to attend school or perform military service, and to find a roughly equal number of men and women, from all walks of life and education levels. A few contacts were made from Fairbanks, Alaska, before the field work began.

2.2 Field Work

Field work was carried out over 2 weeks in May, 2010, based from a cottage in Round Pond, Maine. Over the course of 3 days, 6 women and 6 men at the Chewonki Foundation, an environmental education school in Wiscasset, volunteered to participate in the study. Audio and video recordings were made as they told a little about their backgrounds, then read the prepared narrative (Appendix A) and frame sentences (Appendix B). Each interview lasted 10 to 15 minutes. 4 more interviews of the same type were given to friends of the Chewonki volunteers at their homes or workplaces.

Several days were devoted to traveling around the area with the local farrier,

Fred Bowers of Alna, interviewing, in the same manner, 5 horse owners, most of whom are farmers. Mr. Bowers also set up interviews with his wife and his stepmother, both lifelong Mainers, and a friend who owns the local hardware store. Mr. Bowers himself was eliminated from the data set, although he insisted upon participating, because he was raised in Pennsylvania, and came to Maine as an adult.

The remainder of the interviewees included the author's cousin, who grew up in the area and now lives in Mt. Vernon, Maine, an old friend of hers in Newcastle, two people she recruited at the lobster pound in Round Pond (a part of Bristol), and finally her son, who grew up in Mt. Vernon. The son was the only person in the 20-29 age bracket who was available for interview. Sociological data on the speakers is shown in Table 3.

Table 3. Sociological data on speakers.

Speaker	Town	Gender	Age	Years in Maine	Education level	Left state for education	Mother from Maine	Father from Maine
A	Woolwich	F	40-49	all	nurse	no	yes	yes
B	Damariscotta	F	60-69	all	BA, Colby, M.Ed., U.ME, teacher	no	MA	Ohio
C	Wiscasset	F	50-59	most	BA, in NJ, development director	yes	MD	MA, MD
D	Wiscasset	F	80-89	All but 2	nurse	no	yes	yes
E	Wiscasset	F	50-59	all	HS, cafeteria worker	no	yes	yes
F	Bath	F	60-69	all	BA?, office worker	yes	yes	yes
G	Woolwich	F	40-49	all	office worker	no	yes	yes
H	Wiscasset	F	40-49	All but 6	office worker	no	yes	yes
I	Wiscasset	F	60-69	all	BA, librarian	no	yes	yes
J	Wiscasset	F	70-79	All but 2	low level worker in local high school	no	yes	yes
K	Alna	F	50-59	all	BA, MA, state employee	no	yes	yes
L	Dresden	F	40-49	all but 5	unknown; office worker	no	yes	yes
M	Wiscasset	F	60-69	all	nurse	no	yes	yes
N	Cushing	F	60-69	all	high school, farmer	no	yes	yes
O	Newcastle	M	50-59	all but 12	BA, teacher	no	yes	NJ
P	Nobleboro	M	40-49	all	?, farmer	no	yes	yes
Q	Damariscotta	M	30-39	all	BA, maintenance worker	yes	RI	RI
R	Round Pond	M	30-39	all	cooking school; runs lobster pound	yes	yes	yes
S	Wiscasset	M	60-69	all	BA, teacher	no	yes	yes
T	Wiscasset	M	50-59	All but 2	?, maintenance man	no	yes	yes
U	Alna	M	50-59	All but 2	BA, outdoor adventure teacher	no	yes	yes
V	Alna	M	50-59	All but 2	hardware store owner	no	yes	yes
W	Brunswick	M	50-59	All but 2	unknown; carpenter	no	yes	yes
X	Mt. Vernon	M	20-29	all	B.A., maintenance	yes	yes	MN
Y	Cushing	M	60-69	all	unknown; carpenter	no	yes	yes
Z	Round Pond	M	30-39	all	high school, unknown	no	yes	yes

Audio recordings were made using a Tascam DR-07 digital recorder, with backup recordings made using an iPod with a Griffin Technology iTalk recorder. Videos were made using a handheld Canon Powershot digital camera. In most instances, the Tascam recording was used for analysis, but in two cases, where the background noise level was high, the iPod recording was preferable. Samples of the recorded Narrative (4 speakers) and Frame (4 speakers) data are included on the CD in Appendix C.

2.3 Data Reduction

Vowels can be distinguished by the characteristics of the pitches associated with their overtone structure (Ladefoged, 2001). Several of these so-called formants taken together constitute the sound of the vowel. The first and second formants distinguish the vowels. The third formant is sometimes used for auxiliary purposes. The shareware speech-processing software program Praat, Version 5.1.31, was used in this project to examine the sound spectrum of the collected data and to determine the formants.

Pertinent tokens were entered on a spreadsheet, one for each speaker, and tokens were analyzed using Praat. Column headings for this spreadsheet have been carried throughout the project on many iterations of these spreadsheets and corresponding text files. The spreadsheets took the form of Table 4.

Measurements were taken by hand in Praat, at the center of vowels with long

Table 4. Example of data reduction spreadsheet.

speaker	vowel/frame	context	F1	F2	F3	F4	Time/sec
F	cot	(his) cot (to)	777.756936	1532.966324	2696.486751	3934.798837	301.629989
F	caught	Sarah said caught again	743.873662	1256.107795	2778.609484	4092.084870	375.214567

duration of one frequency, or at the central changing point of the vowel, according to the method of Labov (2001):

> The major operations (sic) of most vowel measurements is to extract the central tendencies of the first two formants at a point in time that represents the acoustic impression of the location of the nucleus. … Though there are many reasons to believe that information from F3 and F0 enters into judgments of vowel timbre, plots of F2 and F1 have proved to give a satisfactory framework for tracing a wide range of vowel shifts in progress.

Although F4 was never analyzed in this study, it is included on the spreadsheets for completeness.

Among several of the male speakers, Praat's formant listing showed a large jump in F2 in several of the pertinent words. An example is shown in Figure 6; this is the word *fodder* from Speaker Z. In these instances, values for F1 and F2 were picked in Praat by examining the direction in which the two formants are moving, and making an estimate of their location in the dark areas indicating formant. On this issue, Labov (2001) states:

> Different LPC measurements will not only vary in values for the formant locations, but frequently vary in the number of formants shown. An F2 in one measurement will re-appear as an F3 in another, while the old F3 now appears as F4, and it is not a simple matter to decide if the new F2 represents an artifact or the phonetic signal. … To detect errors of this

kind requires repeated checking of measurements against auditory impressions. This can be done only after several hundred tokens are assembled into a single two-dimensional plot: until then, outliers and aberrant measurements will not be easily detected.

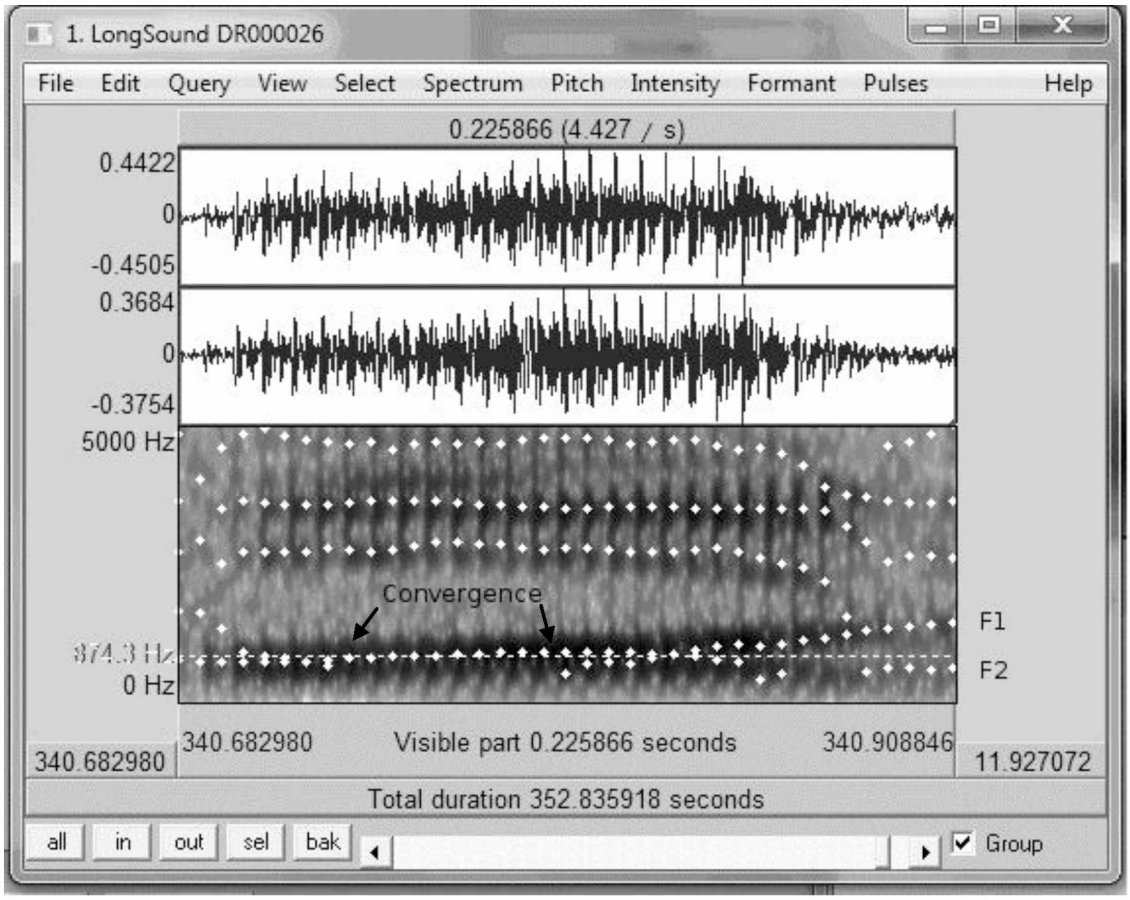

Figure 6. An example from Praat showing the close spacing of F1 and F2 in the vowel of the word *fodder*.

CHAPTER 3 DATA ANALYSIS

3.1 Normalization

Because different speakers have vocal tracts of different sizes and shapes, these physiological differences cause differences in speech resonances, making it difficult to compare speakers (Thomas and Kendall, 2007). These resonances are measured as formant values. In general, formant values for male speakers are lower and more compact than those of female speakers, even when they might come from the same town and speak the same dialect. The process of normalization minimizes these differences, allowing direct comparison of speaker vowels.

Labov (2001) and Adank, Smits, and van Hout (2004) examined normalization methods based on three factors:

1) the preservation of phonemic variation in the transformed vowel data,

2) how well anatomical/physiological differences are reduced; and

3) how well sociological differences are maintained.

Adank, Smits, and van Hout found the Lobanov method to be best, with Nearey1, a log-transformation, to be a close second. Labov (2001) found Nearey1 to be best:

> The results show that normalization procedures that use information across multiple vowels ("vowel-extrinsic" information) to normalize a single vowel token performed better than those that include only information contained in the vowel token itself ("vowel-intrinsic" information). Furthermore, the results show that normalization procedures that operate on individual formants performed better than

those that use information across multiple formants (for example, "formant-extrinsic" *F*2-*F*1).

Both of these methods, however, are vowel-extrinsic, and depend on a comparison of all of the vowels of each speaker. Adank, Smits, and van Hout (2004) state that vowel intrinsic normalization methods are very poor.

Several normalization methods were tried in this project using NORM: Vowel normalization suite 1.1, a freeware software program written by Eric R. Thomas and Tyler Kendall (2007). Including values for F3 seemed to make no discernible difference in results, so its inclusion was abandoned. Because this project deals with only one vowel or its close neighbors, a vowel-intrinsic method is indicated for normalization. The project is seeking to detect sociolinguistic (that is, dialect) differences. Nearey1 was used for normalizing data, and was used for some comparison testing, though it is vowel-extrinsic, and therefore data is skewed. After much trial and error, normalization was abandoned for lack of a good method of normalizing only one vowel, and data sets were divided into separate sets for men and women for the remainder of the analysis. Had the project been designed to examine each speaker's entire vowel space, then the vowel-extrinsic Nearey1 would have been useful for normalizing the data, but the lack of data for vowels other than low back made that approach untenable.

3.2 Comparison of Narrative and Frame Data

To determine whether pertinent vowel sounds differ between the tokens included in the narrative and those included in the context frame, means of F1 and F2 were compared. Data for men and women were compared separately. The data was

separated as to its source in the Narrative or the Frame sentences. Welch Two-sample t-tests were run using the freeware statistical software package R (R Development Core Team, 2010) on this data, first on F1, then on F2. For men for F1, at 95% confidence interval, the resulting p-value is 0.5093, indicating that the null hypothesis holds, and the means for F1 are statistically the same. For men for F2, at 95% confidence interval, the resulting p-value < 0.0001, indicating that the alternative hypothesis, true difference in means is not equal to 0, holds. For women for F1, at 95% confidence interval, the resulting p-value is 0.007, indicating that the alternative hypothesis, true difference in means is not equal to 0, holds. For women for F2, the resulting p-value is < 0.0001, indicating that the alternative hypothesis, true difference in means is not equal to 0, holds. These results are summarized in Table 5.

Table 5. Results of T-test comparison of Narrative and Frame data.

	Men		Women	
	F1	F2	F1	F2
P-value	0.5093	<0.0001	0.0066	<0.0001
Mean Narrative	644.0446	1065.4114	724.3841	1206.3360
Mean Frame	647.6684	973.1469	738.5487	1169.3810

As a result of three of the means being very different, Narrative and Frame data were separated for the remainder of testing, and four separate data sets (Narrative for men, Narrative for women, Frame for men, and Frame for women) were used throughout the project.

3.3 Removal of Outliers

Outliers to the data are values far outside the expected range for normally

distributed data (Adler, 2010). R was used to produce boxplots that show the interquartile range of the data, that is, the range between the 25th and 75th percentile, and the median of the data. Whiskers outside the interquartile range mark the "adjacent values", which begin at the quartile value plus 1.5 times the length of the interquartile range. Outliers fall outside of the whiskers. Low values are calculated with the formula f[2] – 1.5*(f[4]-f[2]), where f(2) is the lower quartile and f(4) is the upper quartile. Similarly, high outlier values are calculated with the formula f[4] + 1.5* (f[4]-f[2]). An attempt was first made to identify outliers using the four data sets described above:

- Narrative data for women
- Narrative data for men
- Frame data for women
- Frame data for men.

Because the F1 and F2 formant values differ widely among speakers within the data sets, few outliers were identified. Many values known to be outliers from the NORM plots earlier produced did not show up using this method.

More satisfactory for finding outliers was to separate each data set by speaker and calculate outliers for each speaker for both Narrative data and Frame data. In general, this produced few outliers per speaker, though more outliers overall than all speakers taken together. Outliers are shown as open circles above and below the whiskers in the boxplot of Narrative Data for F2 for men in Figure 7. Checks of the exact formant values of the outliers were made by calculating outliers using the above formulas in R. After outliers were removed, formant plots for all speakers, such as that

shown for Narrative Data for speaker P in Figure 8, were generated to examine the vowel spaces for each speaker.

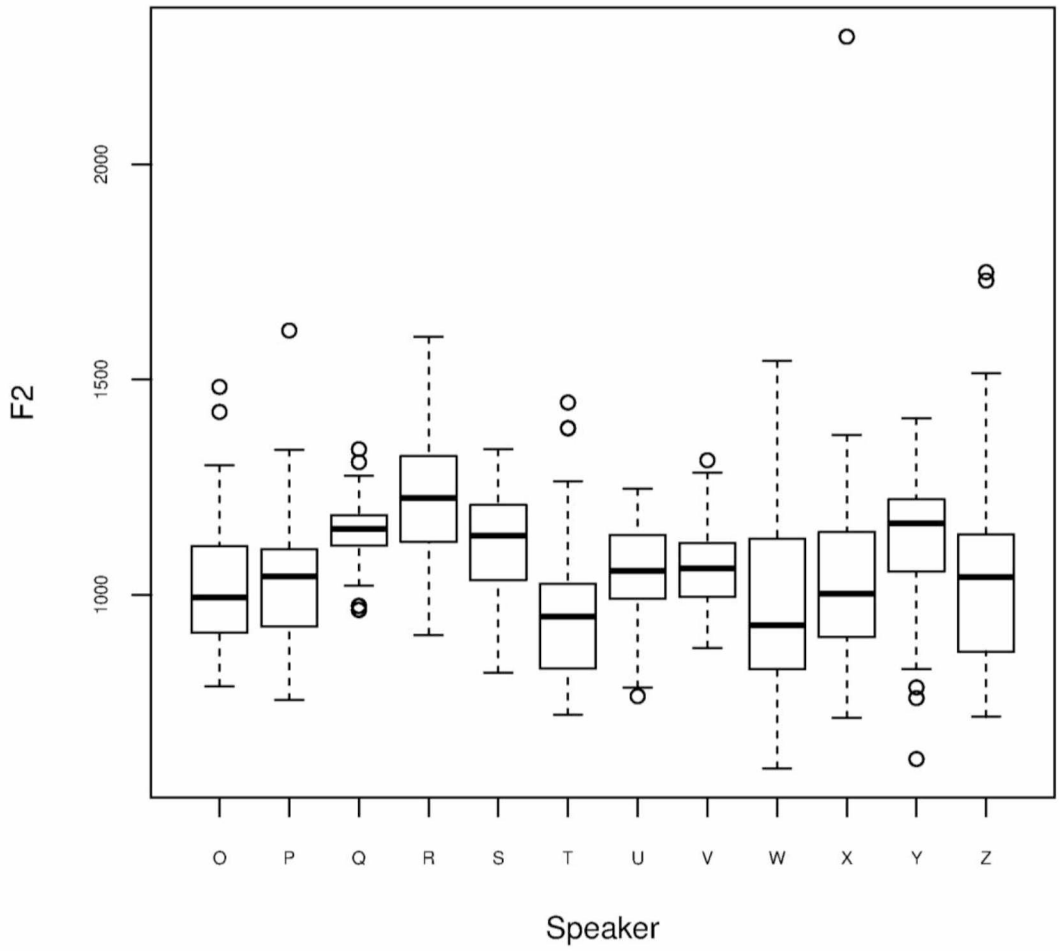

Figure 7. Boxplot of Narrative Data for F2 for men showing outliers as open circles above and below the whiskers.

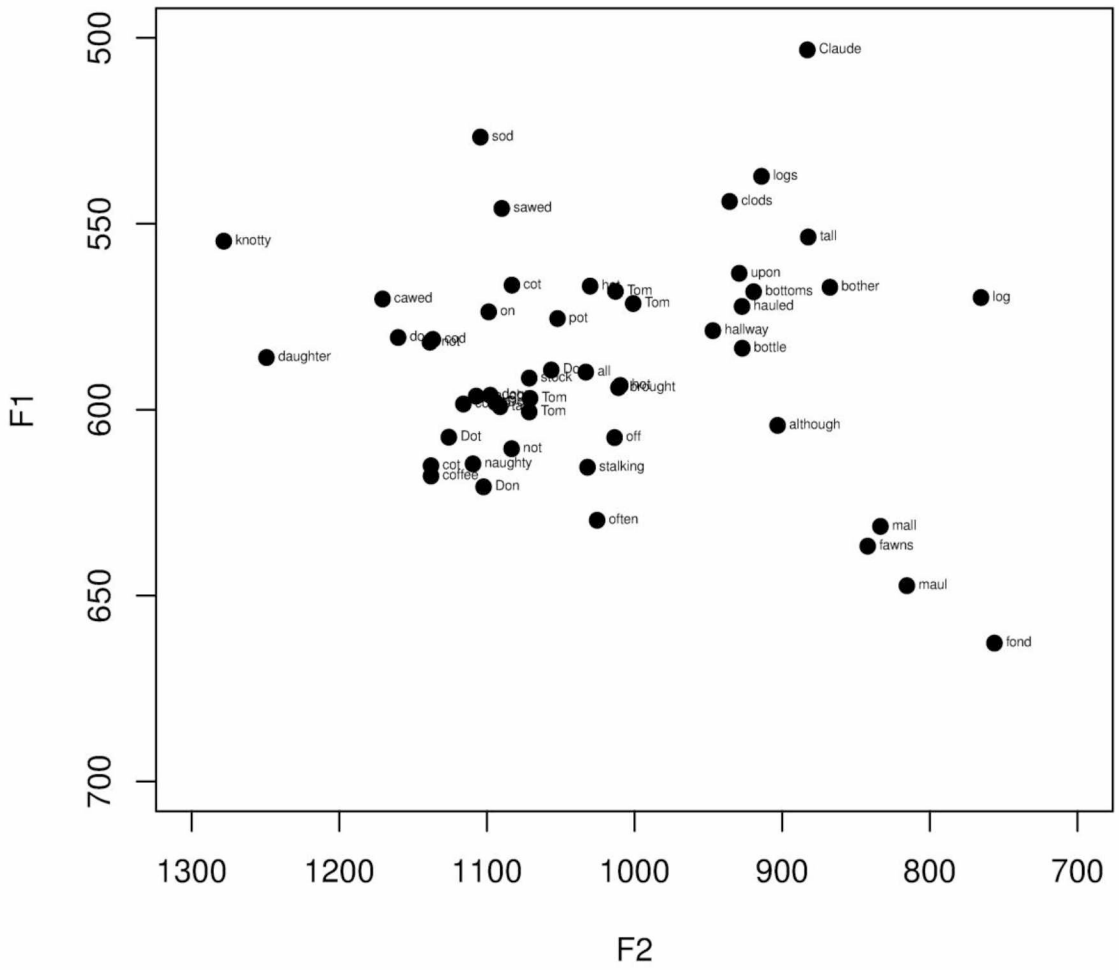

Figure 8. Formant plot for male Speaker P, Narrative Data, illustrating the spread for the [ɑ] vowel.

3.4 Got

One word did not fit the expected phoneme for a low back vowel. The word *got*, which was expected to be pronounced /gɑt/, is almost universally pronounced /gʌt/ in this area, producing a word identical to *gut*. This is true whether in citation form or

noncitation form. By contrast, the expected /ɑ/ phoneme was recorded in the word *hot*. Because of this phonemic difference, the word *got* was removed from the data set and analyzed separately. A formant plot for all speakers is shown in Figure 9. F2 values can be seen to be much higher than for the other words examined in this study, with a mean of 1506.55. The mean of F1 values is 665.24.

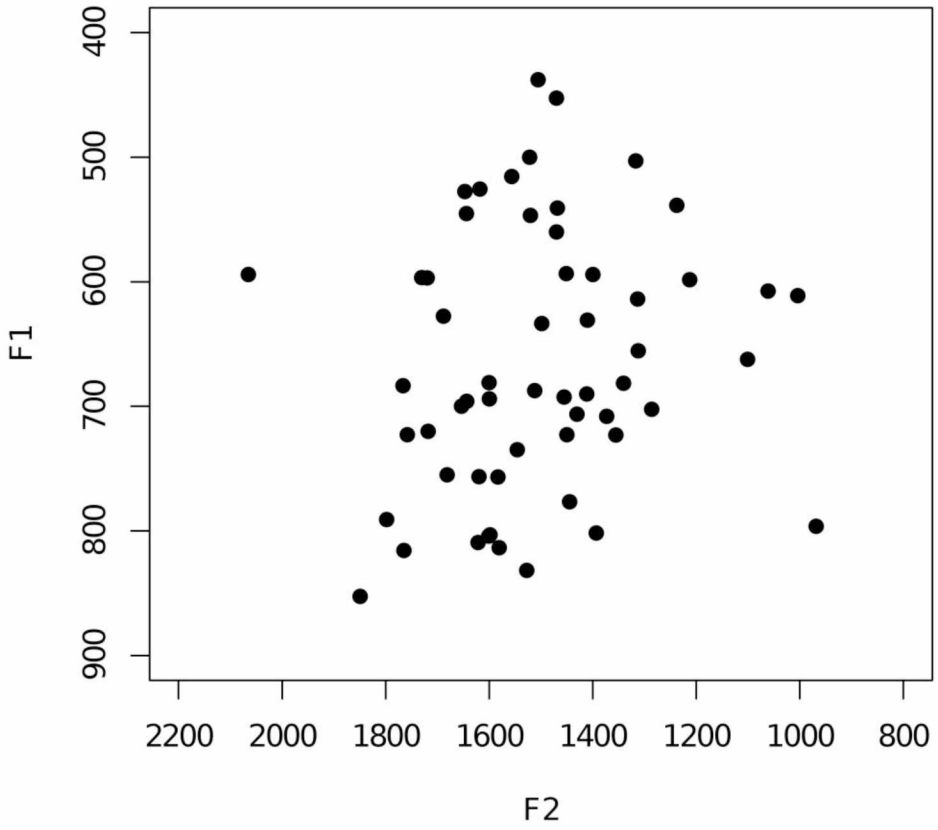

Figure 9. Plot of F1 and F2 for all speakers for *got*.

3.5 Comparison of Nasals and Non-nasals

The presence of a nasal consonant following a vowel (CVC_N) can change the character of the vowel (Ladefoged, 2001). To test whether the presence of nasals in this

study changed the mean F1 and F2 values of the low back vowels, the data sets were separated once again, this time on the basis of following nasal consonants. This procedure yielded a total of 8 data sets. For the t-tests, means of vowels with following nasals were compared to means of vowels with following non-nasals for F1 and F2 for each of our 4 sets (Narrative and Frame data for men, Narrative and Frame data for women). Results of the t-tests are shown in Table 6.

Table 6. T-test results of following non-nasals and nasals by speaker. P-values in bold are greater than 0.05, and the null hypothesis, that sounds are the same, holds.

	Frame Data						Narrative Data					
	F1			F2			F1			F2		
speaker	mean non-nasals	mean nasals	P-value	mean non-nasals	mean nasals	P-value	mean non-nasals	mean nasals	P-value	mean non-nasals	mean nasals	P-value
A	741.8145	664.3114	0.0018	1164.2582	1140.7643	**0.4428**	710.7602	657.3779	0.0044	1208.7983	1142.1557	0.0082
B	738.6380	670.7000	0.0001	1188.1700	1199.3613	**0.5924**	716.5121	685.2723	0.0163	1222.0279	1278.5415	0.0028
C	707.3086	614.0829	0.0357	1089.6705	1115.8043	**0.3038**	710.7368	716.9433	**0.7902**	1129.0305	1183.9822	0.0098
D	639.3353	664.0600	**0.2100**	1096.7468	969.8300	0.0487	605.2587	547.0438	0.0085	1087.9973	1096.4785	**0.7439**
E	817.2043	849.1614	**0.4288**	1321.9868	1312.3671	**0.8009**	744.1245	755.9293	**0.2775**	1284.5805	1308.1057	**0.1743**
F	717.9280	657.2583	0.0083	1338.6964	1314.6683	**0.7469**	711.5040	680.8500	**0.0936**	1329.0613	1325.5264	**0.9299**
G	762.2258	807.0217	**0.2666**	1218.4074	1178.1350	**0.3124**	749.5165	800.9509	0.0175	1261.1374	1325.0382	**0.0519**
H	836.9503	841.1000	**0.8811**	1217.8110	1144.7150	**0.3094**	843.1700	859.7983	**0.2683**	1282.5429	1324.6625	**0.2613**
I	696.7479	585.5288	0.0256	1093.6379	986.8713	0.0069	736.1695	767.3662	**0.2142**	1154.1814	1162.7338	**0.7454**
J	653.8829	637.0800	**0.6457**	983.7132	937.0800	**0.3730**	592.9124	603.3162	**0.5204**	995.4929	995.0808	**0.9902**
K	748.0628	710.5500	**0.6731**	1198.0020	1200.5463	**0.9354**	751.7091	740.3118	**0.7683**	1180.9156	1258.5373	0.0378
L	850.8376	820.3417	**0.4935**	1167.0126	1154.8867	**0.7337**	846.2993	831.1318	**0.5188**	1262.6715	1282.1836	**0.4320**
M	752.1536	719.8071	0.0055	1191.9818	1099.6943	**0.0534**	754.1202	747.6857	**0.5328**	1337.7143	1372.0443	**0.5078**
N	763.7286	707.1800	0.0338	1132.6619	1033.7950	**0.3044**	710.6584	672.8740	**0.0810**	1021.3337	1025.3990	**0.9054**
O	656.9536	678.4838	**0.1786**	965.7500	1012.9050	**0.4494**	662.5016	678.4838	**0.2938**	1002.0268	1092.0550	**0.0566**
P	625.5375	664.8150	**0.3322**	1013.1061	1042.3050	**0.5885**	585.8565	664.8150	**0.0626**	1031.5183	1344.2071	**0.0836**
Q	682.7054	759.8780	0.0104	1071.7778	1054.1380	**0.2664**	668.8934	721.0793	0.0183	1149.4568	1184.7913	**0.0831**
R	795.3218	858.4286	**0.1080**	1054.8282	1001.3086	**0.1467**	781.9283	821.8273	**0.1305**	1230.1124	1281.5800	**0.3028**
S	607.9527	621.5120	**0.5469**	999.1366	894.4840	**0.1372**	606.3682	637.6994	0.0120	1108.8175	1146.5313	**0.3281**
T	624.9731	639.9433	**0.0788**	947.9026	928.9333	**0.7608**	619.4580	635.1660	**0.1463**	947.9378	952.4333	**0.9297**
U	643.2727	627.3850	**0.5013**	939.4484	834.4925	0.0005	644.9970	653.5547	**0.4929**	1065.4623	1021.7780	**0.1369**
V	616.1498	635.9314	**0.0795**	970.3595	928.8286	**0.2101**	615.4760	640.2250	0.0265	1070.7788	1045.0225	**0.3216**
W	574.7808	513.2400	**0.1660**	721.8664	695.3750	**0.5341**	606.3038	567.0540	0.0148	1057.4216	1008.3213	**0.5972**
X	686.3343	661.3457	0.0292	933.7507	1095.4029	**0.1018**	685.1517	677.0175	**0.4729**	1349.9798	1185.3831	**0.1824**
Y	534.9783	497.0617	0.0055	1035.0163	1040.6250	**0.8793**	515.7549	463.9780	0.0145	1157.5441	1157.2527	**0.9942**
Z	747.6394	831.9233	0.0010	991.3023	1075.2733	**0.2205**	763.5004	868.7321	0.0002	1402.2907	1326.4071	**0.5841**

As can be seen from Table 6, the great majority of P-values support the null hypothesis, that the means of F1 for following nasals and non-nasals are the same, and the means of F2 for following nasals and non-nasals are the same. Every speaker has at least one formant mean that is the same for vowels followed by nasals and non-

nasals. Most have several that are the same. Because the great majority of cases have the same F1 and F2 means for following nasals and non-nasals, the two groups were not treated separately for the rest of the study.

3.6 Comparison of F1 and F2 by Leading Consonant

Formants F1 and F2 that characterize a vowel sound are dependent upon the shape of the vocal tract (Ladefoged, 2001). This shape is influenced by the place of articulation of the consonant that precedes the vowel. In order to look at whether the preceding consonant has a significant effect on F1 and F2 for the vowels in question, the data in each data set were grouped by place of articulation. These groupings include labial (/b/, /f/, m/ /p/), alveolar (/d/, /t/, /l/, /n/, /s/), velar (exclusively /k/ in these data sets), palatal (exclusively /j/), and glottal (exclusively /h/) consonants. For each data set, an Analysis of Variance test by place of articulation of the preceding consonant was run using R. The function oneway.test was used for the ANOVA calculation. Means for each formant for each data set were also calculated with R. Results are shown in Table 7.

Table 7. ANOVA results by place of articulation of preceding consonant by data set.

	Frame Data				**Narrative Data**			
	Men		Women		Men		Women	
	F1	F2	F1	F2	F1	F2	F1	F2
P-value	0.68920	<0.0001	0.07937	<0.0001	0.62700	<0.0001	0.08676	<0.0001
mean labial	647.84	925.39	733.78	1137.59	647.84	925.39	711.22	1132.50
mean alveolar	651.26	1011.78	741.34	1193.99	651.26	1011.78	723.79	1224.53
mean velar	639.26	991.83	736.17	1186.67	639.26	991.83	735.01	1228.30
mean palatal	654.53	1072.05	729.76	1243.15	654.53	1072.05	758.26	1240.79
mean glottal	657.96	947.03	765.60	1157.66	642.56	947.03	728.99	1169.57

The P-values for F1 that resulted from these ANOVAS support the null hypothesis at the 95% confidence level. This shows that the means for F1 are statistically the same

across the data sets. The preceding consonant has no effect on F1 at the point measured. P-values for F2, however, reject the null hypothesis, saying that the means are statistically different. There is a trend to the F2 means that can be observed in Table 7: Labial F2 values are lowest across data sets, followed by glottal values. Palatal values are the highest.

The "second formant is affected by both backness and lip rounding" (Ladefoged, 2001). Ladefoged goes on to say that considering the second formant in relation to the first can eliminate some of the lip rounding effects. The closer the frequencies of F1 and F2, the more back the vowel sounds. Speakers X and Z in particular have very close F1 and F2 values.

Looking at Table 7, F1 is statistically the same for all places of articulation for each data set. The vowel holds a steady position in terms of height (low). F2 varies across the data sets. In this case the vowel is more back following labial consonants and more fronted following palatal "y", with the other positions falling between these. According to Labov (2001),

> ...the goal is to be sure that when one token is heard as distinctly higher than another it will show a lower Fl in the two-formant plot, and that when a second token is heard as distinctly backer than another, it will show a lower F2 measurement.

Further testing for the project was done without regard to the preceding consonant because F1 measurements are consistent without regard to place of articulation of the consonant, and F2 measurements, although variable, depend on several factors

discussed above, such as lip rounding, that are difficult to measure.

CHAPTER 4 MERGERS

4.1 The *Caught/Cot* Merger

An attempt was made to use the Cambridge English Pronouncing Dictionary (Jones, 2006) to separate the words from which vowel tokens are being examined into two lists. The prevailing pronunciation according to this source, however, for almost all of the words, listed the vowel token as /ɑ:/, with a pronunciation as in *father*, a British pronunciation. This referenced vowel sound is further back for this word than this project has seen in this Maine phoneme for this word class, so this reference was not useful for testing the separation of a central to low back vowel. This reference, although supposedly including American pronunciations, does not do so for this phoneme. For an attempt at which words may once have belonged in the /ɔ/ category and which in the /ɑ/ category, Dr. Gordon B. Cooper, Interim Dean, Professor of English, and dialect scholar, of the University of Alaska Fairbanks, was consulted, and the words were divided as he indicated, shown in Table 2.

T-tests were then run using R (R Development Core Team, 2010) on the usual sets of data for men and women, Narrative and Frame data to test for potential phoneme differences. Table 8 shows the results of the preliminary t-tests. The null hypothesis is

Table 8. T-test results for /ɑ/ and /ɔ/.

	Men				Women			
	Narrative		Frame		Narrative		Frame	
	F1	F2	F1	F2	F1	F2	F1	F2
P-value	**0.15758**	0.00067	**0.06339**	0.00007	**0.86011**	**0.33076**	0.03775	0.00003
Mean /ɑ/	651.45423	1086.88679	657.71542	999.13762	723.89841	1212.79317	749.19020	1195.96421
Mean /ɔ/	641.25693	1045.16173	643.18963	951.82594	725.11486	1201.82236	733.73445	1151.74781

supported for three of the four F1 values, but for none of the F2 values. Due to variance among speakers, the tests were rerun after separating the data sets by speaker. Results of those tests are shown in Table 9. Speaker by speaker, the great majority of results support the null hypothesis, that there is no phonemic difference between these sets of words. In other words, no minimal pairs exist between words such as *cot* and *caught* or *Don* and *dawn.* Two speakers in particular, however, are very different from the majority. Speaker C, a woman, and Speaker O, a man, show results that support the alternative hypothesis, a difference in phonemes, in three out of four cases. Not only are there statistical differences, but they are much greater than for any other speakers. These, interestingly, are the two speakers who did not spend their childhoods in Maine; speaker C came from western Massachusetts and speaker O from Connecticut as older children beyond the age of acquisition. In previous tests, this difference was not evident.

The separation of General American words into /ɑ/ and /ɔ/ words generally shows no difference due to the consonant following this vowel. We have previously seen this to be true of following nasals. There are, however, a large number of following lateral approximants in the list, all of which are listed as using /ɔ/. Tests were run to see whether this was also true for the mid-coast Mainers. Results of these tests

are shown in Table 10. In all of the data sets, the null hypothesis, that vowels preceding laterals and non-laterals are the same, holds for F1. The height of the sound in all cases is about the same.

Table 9. T-test results for /ɔ/ and /ɑ/ by speaker.

an /ɑ/	mean/ɔ/	P-value	mean /ɑ/	mean/ɔ/	P-value	mean /ɑ/	mean/ɔ/
181.2794	1198.4942	**0.5006**	710.9905	744.2003	0.0448	1160.4715	1161.3961
251.5682	1236.2452	**0.4511**	739.7147	719.8393	**0.2750**	1207.1916	1179.1073
171.9452	1111.0952	<0.0001	706.5142	686.0590	**0.3497**	1138.9316	1064.5697
088.6887	1084.2535	**0.8644**	650.6806	636.3843	**0.3898**	1119.6100	1065.5511
297.8070	1290.8413	**0.7026**	847.5806	806.0638	**0.0518**	1339.4339	1308.8355
334.8694	1338.2992	**0.9333**	722.8345	702.5230	**0.1926**	1408.5100	1287.3483
273.3921	1285.3576	**0.6839**	774.8978	763.5381	**0.5366**	1234.8578	1201.0610
316.3437	1280.9996	**0.2758**	845.7940	832.8054	**0.2053**	1239.7307	1195.6261
164.6463	1160.2210	**0.8485**	693.1458	671.0819	**0.3986**	1092.6389	1067.5394
006.9571	989.2009	**0.5491**	663.6756	643.4716	**0.2260**	1001.7778	961.3800
191.1915	1214.6859	**0.5087**	789.5711	710.5193	**0.0718**	1254.1053	1161.9466
295.4208	1270.2518	**0.4102**	849.6644	845.4423	**0.8606**	1189.3928	1151.1593
374.1750	1311.7330	**0.1437**	751.9525	744.9794	**0.5047**	1192.0920	1171.0716
022.8607	1020.5260	**0.9426**	760.6062	756.8544	**0.7986**	1131.4608	1118.5933
057.6172	964.9248	0.0069	674.6421	643.8745	**0.0592**	1061.6011	916.1294
042.0354	1011.3904	**0.3636**	618.1526	623.6232	**0.6189**	1046.6437	998.2023
157.2530	1146.5208	**0.4727**	697.9528	686.6843	**0.4047**	1080.5133	1063.0121
238.1052	1254.7637	**0.6966**	853.5453	776.4234	0.0050	1061.7941	1037.8262
131.8645	1104.9886	**0.3932**	608.9181	609.6977	**0.9385**	1001.7406	980.3057
948.2660	899.0400	**0.1045**	630.5022	624.6497	**0.2747**	976.9106	926.7040
070.4947	1037.6610	**0.2340**	649.3230	635.5194	**0.3071**	945.8095	909.2338
075.1494	1041.5296	**0.1457**	622.7721	616.5859	**0.5280**	981.1658	953.2548
992.9024	881.4635	0.0310	565.8840	566.9210	**0.9661**	692.6493	731.1767
073.2471	1045.1695	**0.5250**	671.3089	689.4161	0.0433	995.6350	934.3200
170.4392	1144.4808	**0.4582**	542.4550	522.4928	**0.1162**	1078.4044	1009.2462
097.8490	1007.9330	**0.0562**	756.9241	765.0325	**0.7390**	1021.5312	990.7990

F2

P-value
0.9603
0.0368
<0.0001
0.0588
0.2015
0.0139
0.0694
0.1104
0.3600
0.1710
0.0010
0.0977
0.5315
0.7015
<0.0001
0.0909
0.2663
0.5262
0.5716
0.0430
0.1508
0.1786
0.2316
0.1709
0.0157
0.5208

Table 10. T-test results for following lateral approximants.

	Men				Women			
	Narrative		Frame		Narrative		Frame	
	F1	F2	F1	F2	F1	F2	F1	F2
P-value	0.3165	<0.0001	0.0566	<0.0001	0.3116	<0.0001	0.2971	<0.0001
Mean Lateral	639.6403	965.5994	635.8704	898.6861	716.5824	1128.5340	732.3257	1090.3760
Mean Non-Lateral	649.5090	1075.1679	653.1730	980.6773	725.5248	1214.9730	741.1375	1184.9600

All of the above tests show that *caught* and *cot* have the same vowel in this region of Maine. There is no phonemic difference creating minimal pairs. Nagy, Roberts, and Boberg (2000) found the same result: "Words such as *cot* and *caught, stock* and *stalk* sound the same in most of Eastern New England, both having a more or less rounded vowel pronounced in the low-back corner of the mouth."

4.2 The *Father/Bother* Merger

Specific tokens aimed at uncovering this possible merger were not collected with this data set. A few words with the /a/ sound like in *father* present themselves in the initial interviews given to participants for their sociolinguistic data. One such word occurs in the narrative: *Barker*. As with many of the pertinent words from many of the speakers, such as *farm*, *farther*, and *part*, this is a sound generally pronounced in a non-rhotic manner, which makes the vowel sound longer and less rounded.

A century ago, and more recently still, words like *bath* and *afternoon* were pronounced with a central /a/ sound like in *father*. According to Kurath (1939), such pronunciation is "losing ground in the countryside". He goes on to say

> It is significant that both the social shibboleth *696 can't* and the rustic *114 pasture* have [a] more widely than other words of this type and that

> the rather recently introduced term *524 casket* (for older *coffin*) almost universally has the vowel [æ] of *cat*. As a result of antagonistic and shifting trends, usage is much confused in Eastern New England at the present time and few persons in this area have a fixed pattern.

The vowel in *aunt*, however, remains strongly /a/ to this day (Nagy and Roberts, 2004).

Labov (2001) studied mean values for F2 across social classes in Philadelphia vowels. Of interest here are his findings for F2 for /a/. His F2 values range from about 1800 for Upper Class speakers to 2000 for Lower Working Class speakers. On page 180, he shows a formant plot for a male speaker involved in the *father-bother* merger, whose F2 values for /a/ range from 1100 to 1500 with a mean of about 1300.

By contrast, compare the means of the data sets in the present study in Table 11. These values are for the low back vowel. F2 values range from 978 to 1336 with a mean of 1166 for women's Frame data and from 995 to 1346 with a mean of 1202 for women's Narrative data. Men's values range from 718 to 1070 with a mean of 970 for Frame data, and from 925 to 1246 with a mean of 1067 for Narrative data. These F2 values are quite a bit lower than those reported in the literature for the *father-bother* merger, as seen above. The women's values tend to be higher than those of the men. While this difference may have some basis in the vocal tract differences between men and women, studies have found (Wolfram and Schilling-Estes, 2006) that women tend to lead men in dialect changes. Listening to these speakers, more women tended toward a central low vowel than men; these were generally women who had been in workplaces with a more diverse population. The women have somewhat less difference between their

pronunciations of the vowels in *bother* and *father*. Although their vowels in *bother* are somewhat fronted, they can be expressed as /ɑˇ/ and have not yet reached the /a/ vowel of *father*. Several of the men exhibited a very low back vowel, either rounded or unrounded. *Father* and *bother* exhibit distinct phonemes in this population.

Table 11 Mean F1 and F2 values for all speakers.

Speaker	Frame		Narrative	
Women	F1	F2	F1	F2
A	731.18	1161.03	698.51	1193.50
B	727.55	1190.00	709.26	1235.15
C	693.99	1093.40	711.79	1138.36
D	641.58	1085.21	592.21	1089.90
E	821.96	1320.55	746.97	1290.26
F	710.65	1335.81	704.47	1328.25
G	767.71	1213.48	759.99	1274.15
H	837.34	1211.01	846.67	1291.41
I	679.30	1076.89	743.28	1156.13
J	651.93	978.29	595.24	995.40
K	741.81	1198.43	749.39	1196.73
L	847.03	1165.50	843.09	1266.80
M	747.71	1179.31	752.62	1345.72
N	758.07	1122.78	703.53	1022.10
Min.	641.60	978.30	592.20	995.40
Mean	739.80	1166.50	725.50	1201.70
Max.	847.00	1335.80	846.70	1345.70
Men	F1	F2	F1	F2
O	655.57	971.41	663.32	1011.27
P	621.54	1016.61	587.38	1024.49
Q	691.09	1069.86	675.99	1152.09
R	810.60	1038.25	788.32	1246.14
S	609.43	987.76	614.72	1118.87
T	626.84	945.53	620.92	924.95
U	640.83	923.30	647.17	1054.36
V	619.03	964.30	621.52	1059.5
W	563.52	716.67	596.12	966.4
X	685.31	935.47	675.59	1022.78
Y	530.14	1035.73	500.82	1157.46
Z	741.63	988.37	778.06	1009.9
Min.	530.14	716.67	500.82	924.95
Mean	587.38	860.16	592.22	978.08
Max.	810.60	1069.86	788.32	1246.14

CHAPTER 5 HISTORICAL EVIDENCE

Historical evidence was examined in order to determine whether the two vowels /ɑ/ and /ɔ/ have indeed merged, as they have in other parts of the US (Labov, 2001), or whether they have always been the same. Kurath (1939) is the main source for historical data. He states:

> The rounded vowel [ɒ] of Eastern New England in words like *45 rod*, *286 johnnycake* and *124 crop* is losing ground. It is used most consistently in the northeast, but has been extensively replaced by an unrounded variety in the Eastern Margin and in such cities as 80 Providence in the Eastern Focal Area. The fully rounded and raised variety [ɔ] is now regarded as rustic. As a result of this trend, some Easterners now have distinct phonemes in *rod*, *crop* and in *724 off*, *550 law*, *291 salt*.

(The numbers here refer to the numbered words and cities in the Linguistic Atlas of New England)

One of LANE's (1939-43) speakers from the coastal region in question is a farmer and miller of age 99 from Waldoboro. His parents were also born in the area. He spent 10 years in Rhode Island when young, then a few years in Massachusetts, then was in the Army in the Civil War. Kurath's field worker characterizes him as having "rather long vowels". An examination of the pertinent vowels collected from this speaker shows a range from /ɔ^{v}/ to /ɒ/ with many instances of /ɒ$^{\wedge}$/. The superscripts used by LANE indicate raising or lowering of the vowel in question. Very

little difference in the back vowel is indicated. In the Handbook (Kurath, 1939), he discusses the fact that /ɒ/ is dominant in Maine, but Western New England uses /ɔ/. Boberg (2001) also found /ɔ/ in Western New England, although as previously discussed, that vowel is now merging to /a/ in that area with the beginnings of the Northern Cities Chain Shift.

The second LANE speaker from the coastal region is termed "cultured"; this is a 50 year old single woman described as "very intelligent". Her vowels track the first speaker closely, though tending more toward /ɒ^/.

The Linguistic Atlas (LANE, 1939-43) also examines the vowels of one, sometimes two, speakers from Farmington, the closest location to Mt. Vernon, home of this study's youngest speaker. The primary speaker was a 67 year old farmer whose parents were raised in the coastal area that is home to most of the speakers this project studies. His vowel is exclusively /ɒ^/. The second speaker from Farmington is a 22 year old Colby College student, studying in nearby Waterville. His vowels track those of his neighbor.

In 1976, an oral history project was carried out in Mt. Vernon. Three of the tapes were borrowed from the Shaw Public Library in Mt. Vernon for analysis by the current project. The tapes include interviews with two speakers, a man age 88 (born 1888) and a woman age 81 (born 1895). Preliminary analysis of these tapes included two of the interviewed speakers as well as the interviewer. The data was analyzed in much the same manner as the contemporary data. A formant plot for the male speaker is shown in Figure 10. Table 12 shows the mean values for these speakers. Mean

values for these speakers are very similar to those of the present-day speakers, shown in Table 11.

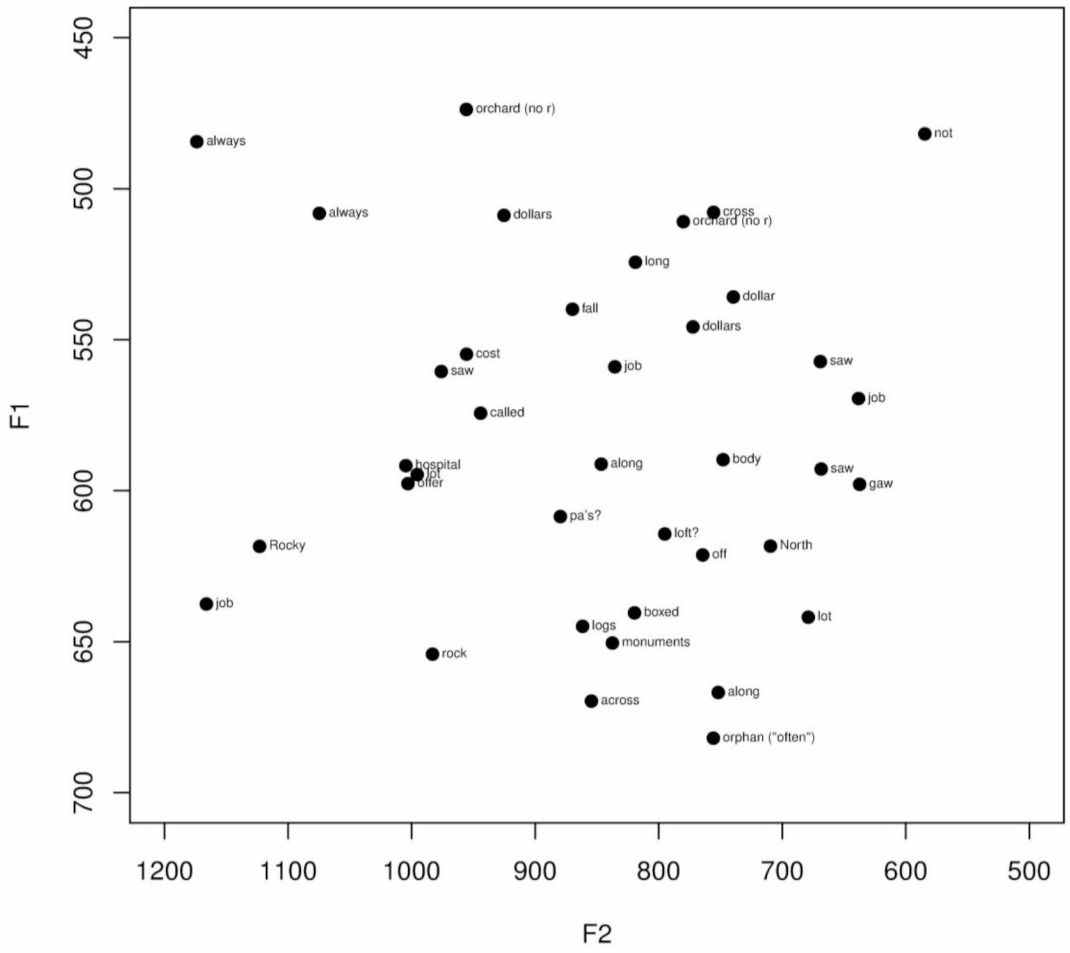

Figure 10. Formant plot for male speaker, born 1888.

Table 12. Mean F1 and F2 values for historical speakers.

Speaker	F1	F2
Grover Currier	582.16	851.4
John Stevens	608.33	909.79
Ruby Robinson	741.68	1314.64

Finally, some older poems were examined to determine whether any of our pertinent vowel sounds have been used as rhymes. Though not definitive evidence, due to the variable nature of rhymes in poetry, the same phoneme is most likely present at the ends of rhyming lines. Robert P. Tristam Coffin was born in 1892 and lived most of his life in Brunswick, Maine. The first verse of his poem *Dawn at Ashdown* illustrates rhyming of three words that indicate the same vowel phoneme, not differing from /ɒ/ to /ɔ/:

Dawn at Ashdown

Our ashwood spears were cold with dawn,
Dew hung the thorntrees. We stood on
And waited for full day to break,
Ringmeshed shoulders stiff with ache;
The stars were growing small and wan.

Two couplets from *Plowman Without a Plow* illustrate the same thing:

And it would make him happy now, she thought,
To live on one again. But there was not

When the last of all he held was gone,
He turned and walked uphill against the dawn,

CHAPTER 6 DISCUSSION AND CONCLUSIONS

6.1 Discussion

The Northern Cities Chain Shift (NCCS) is one of two patterns of shifting vowels in the US today (Wolfram and Schilling-Estes, 2006), the other being the Southern Vowel Shift. In the vowel space with which this study is concerned, studies of the NCCS show the low-mid back vowel /ɔ/ moving forward and down to displace the central low /ɑ/ (notation of Wolfram and Schilling-Estes, 2006, in this work /a/), which then moves upward and front, pushing /æ/ further up, as in Figure 5. Labov (1991) discusses movements in six phonemes that make words confusing to listeners; the pertinent example for the vowel of concern in this study is the potential confusion of *locks* with *lax* in some speech communities. The movement of vowels in the NCCS occurs across the northern portion of the US, beginning, according to Boberg (2001), in Western New England, though Labov (1991) makes the point that it begins in urban areas (hence the name *Northern Cities*), of which there are none in Western New England. There are no truly urban areas in Northern New England; the small cities of Manchester, New Hampshire, Burlington, Vermont, and Portland, Maine are the largest in each of these states. The large city of Boston, Massachusetts serves as, and is known as, the Hub for the entire region.

Nagy and Roberts (2004) state that "the lack of a merger between low, back, unrounded /ɑ/ (LOT) and mid, back, rounded, lengthened /ɔ/ (THOUGHT)" is one of two essential conditions for the initiation of the Northern Cities Chain Shift. Nagy

(2001) believes that the NCCS is taking place in southeastern New Hampshire due to the desire of the local people to separate themselves from nearby Boston. Around fifty years ago, however, a great in-migration from outside New England took place in that area due to economic changes (personal experience). Taxes in neighboring Massachusetts are relatively high, but there are no sales or income taxes in New Hampshire, and taxes on businesses are low, so this fueled a large economic growth that continues to this day. This has had a greater effect on dialect changes in that area than Nagy noted.

For an examination of the vowel space of one representative speaker in this study, several vowels for Speaker N, a woman in her 60's, were analyzed. Some of the words came from the narrative, but others of them were extracted from the preliminary discussion that elicited her sociolinguistic data. Figure 11 shows the resultant formant plot for this speaker. Words including the [ɑ] phoneme cluster significantly, and they are separate from any other vowel, notable from [a].

Both historical and present-day evidence point to the lack of an effect of the Northern Cities Chain Shift on mid-coast Maine. Although *cot* and *caught* have the same vowel phoneme, it is lower and more back than in the rest of the northern US, as in Figure 6. "As for the lack of a distinction between the vowels in *cot* and *caught,* it is actually the rest of the country that is becoming more like Eastern New England." (Nagy, Roberts, and Boberg, 2000). In fact, this is not the case; the merger taking place with the Northern Cities Chain Shift is producing the single phoneme /a/ in these words, rather than the /ɑ/ that is present in mid-coast Maine and the surrounding area. The

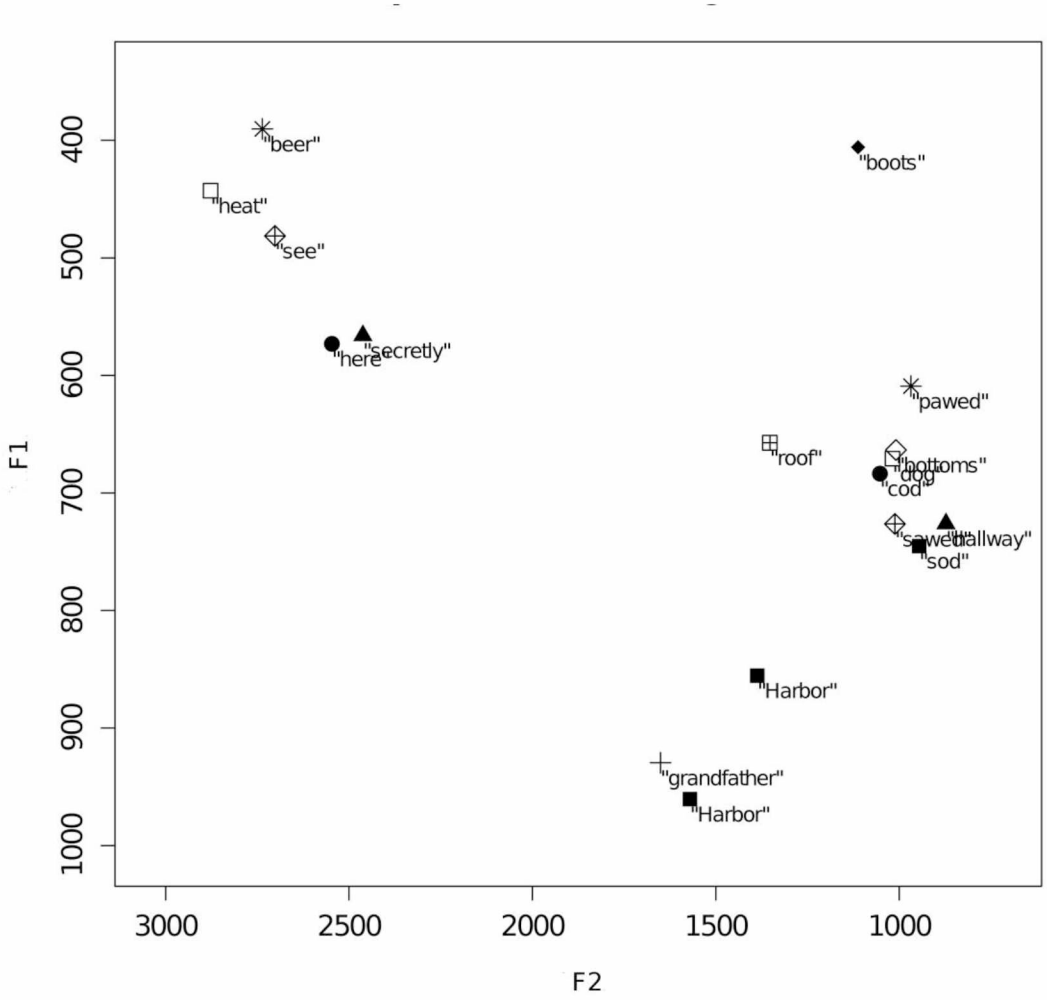

Figure 11. Formant plot for several vowels, 66 year old female speaker.

father-bother merger in other places in the north is not found in the area of this study, either; if movement is present at all, it is in the direction of [ɑˑ], slightly more central than [ɑ].

Tables 11 and 12 and Figure 12 show mean formant values for all speakers, both

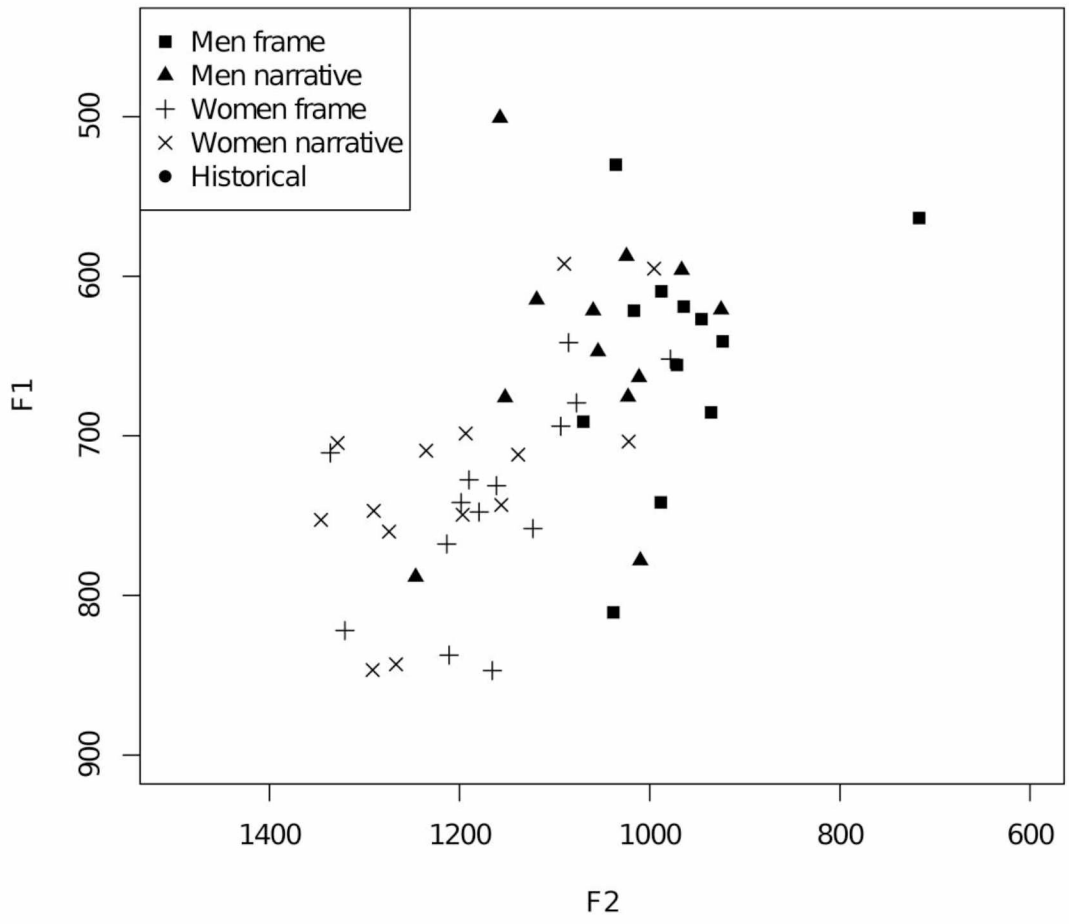

Figure 12. Plot of mean F1 and F2 for all speakers, present-day and historical.

present-day and historical. For women, F1 means for Narrative and Frame data are 739.80 and 725.50 respectively. For F2, means for Narrative and Frame data are 1166.50 and 1201.70 respectively. For men, F1 means for Narrative and Frame data are 587.38 and 598.22 respectively, and for F2, 860.16 and 909.79 respectively.

Gordon (2001) looks at speakers in Michigan whose speech is undergoing change from the Northern Cities Chain Shift. He gives an example of formant frequencies of a female speaker, age 18, for [ɑ] (the range of [a] in this work) where the

mean of F1 is about 1025 and of F2 is about 1800. His use of the symbol [ɑ] is based on the pronunciation of words such as *pot*, the vowel of which has shifted for this speaker, so that it is now in the range of [a]. For the mid-coast Maine speakers, this vowel remains in the domain of [ɑ].

Hagiwara (1997) examined speakers from California. He reports average formant frequencies for [ɑ] as used in the word *hod* by women as having an average F1 of 997 and an average F2 of 1390. For men he reports an average F1 of 710 and an average F2 of 1221. This contrasts with lower values in the Maine speakers. Hagiwara goes on to say that he has tried to characterize Californian speech without reference to an arbitrary standard.

6.2 Topics for Further Study

The collection of more data on the low central [a] vowel would be very useful in examining differences between that vowel and the low back vowel [ɑ] of this study. It would provide more data on the *father-bother* difference. Historically, this vowel was widespread in this area in words such as *bath* and *dance*, and it persists today in *aunt* and often in *can't* (LANE, 1939-43, Nagy and Roberts, 2004). More speakers of varying ages would allow an in-depth study of small differences over the time frame of a generation. The study would also be furthered by examining a larger geographic area and by the inclusion of children.

6.3 Conclusions

Although no formant measurements are available with the *Linguistic Atlas of New England* (LANE, 1939-43), the information gleaned from the speakers of the area

of this study shows that very little has changed in the dialect of the area since at least the middle of the 19th century. The tapes of older speakers from Mt. Vernon corroborate this finding, as does the poetic evidence of Coffin.

Although there is a range among the F1 and F2 formant frequencies for the vowels studied for the speakers in this project, they fall generally within the area of the low back vowel /ɑ/. Mean formant frequencies for women are higher than those for men, due mainly to differences in the size of the vocal tract. A number of statistical tests were undertaken to show that the vowels in words such as *cot* and *caught* are the same phoneme in this region, while those in *father* and *bother* have been shown to be different phonemes.

The people interviewed for this project in mid-coast Maine do not perceive separate phonemes in the many pairs of words they were given. While recording the sentence data for this project, several speakers said, on seeing the second of a potential word pair, "I already read that one!" When Speaker B, a first/second grade teacher, was reading the Frame sentences during recording for the project, she said spontaneously, "These are all the same! We teach the kids they're all the same!"

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APPENDICES

Appendix A: Narrative

A man named Don Barker lived in the Maine woods in an old log cabin with a sod roof. He hauled wood, and sawed and split knotty logs with his maul for heat in the winter. He caught fish in the summer, mostly cod. One Christmas that was not very merry, his wife Dot passed away. After that he raised his daughter Mary and their dog Claude alone. One day the local game warden, Tom Harrison, came by to talk with them. Tom was fond of Mary and secretly wished to marry her. Don got up off his cot to ask Tom in for a cup of hot coffee, or maybe a bottle of cold beer. "Don't bother to take your boots off," he said, although he could see clods of dirt on the bottoms. The naughty dog pawed at the hallway door to come in. Mary had just been to the mall in town, so she got some crullers she'd just bought out of her stock cupboard and put on the coffee pot. They all sat by the hot stove to eat while the crows cawed outside. Don asked Tom if he'd seen many fawns this spring. "Not more than fourteen," Tom said, "but I wasn't stalking them. They're often down by the pond." Tom finished eating and hauled his tall body out of the chair. Evening settled upon the household as Don settled back onto his cot and yawned.

Appendix B: Context Frame Sentences

Sarah said “mall” again.

Sarah said “caught” again.

Sarah said “hall” again.

Sarah said “clod” again.

Sarah said “bought” again.

Sarah said “fond” again.

Sarah said “sawed” again.

Sarah said “ball” again.

Sarah said “naughty” again.

Sarah said “maul” again.

Sarah said “cod” again.

Sarah said “dawdle” again.

Sarah said “clawed” again.

Sarah said “fawned” again.

Sarah said “dotty” again.

Sarah said “model” again.

Sarah said “haul” again.

Sarah said “Claude” again.

Sarah said “bawl” again.

Sarah said “bottle” again.

Sarah said “maudlin” again.

Sarah said “all” again.

Sarah said “body” again.

Sarah said “haul” again.

Sarah said “talk” again.

Sarah said “hot” again.

Sarah said “fought” again.

Sarah said “pod” again.

Sarah said “bawdy” again.

Sarah said “lawn” again.

Sarah said “tock” again.

Sarah said “pond” again.

Sarah said “knotty” again.

Sarah said “pawed” again.

Sarah said “law” again.

Sarah said “modern” again.

Sarah said “pawned” again.

Sarah said “laud” again.

Sarah said “haughty” again.

Sarah said “cawed” again.

Sarah said “pot” again.

Sarah said “awl” again.

Sarah said “sought” again.

Sarah said “on” again.

Sarah said “Maude” again.

Sarah said “cot” again.

Sarah said “yawn” again.

Sarah said “fodder” again.

Sarah said “sod” again.

Sarah said “coddle” again.

Sarah said “daughter” again.

Sarah said “yon” again.